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PTO/SB/05 (4/98)
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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 C.F.R. § 1.53(b))

Attorney Docket No. RCA 89,936

First Inventor or Application Identifier Chikazawa

Title STEREOSCOPIC DISPLAY DEVICE WITH TWO
BACK LIGHT SOURCES

Express Mail Label No. EL533625127US

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

1. ☒ * Fee Transmittal Form (e.g., PTO/SB/17)
(Submit an original and a duplicate for fee processing)
2. ☒ Specification [Total Pages 10]
(preferred arrangement set forth below)
 - Descriptive title of the invention
 - Cross References to Related Applications
 - Statement Regarding Fed sponsored R & D
 - Reference to Microfiche Appendix
 - Background of the invention
 - Brief Summary of the invention
 - Brief Description of the Drawings (if filed)
 - Detailed Description
 - Claim(s)
 - Abstract of the Disclosure
3. ☒ Drawing(s) (35 U.S.C. 113) [Total Sheets 2]
4. Oath or Declaration [Total Pages 12]
 - a. ☒ Newly executed (original or copy)
 - b. ☐ Copy from a prior application (37 C.F.R. § 1.63(d))
(for continuation/divisional with Box 16 completed)
 - i. ☐ DELETION OF INVENTOR(S)
Signed statement attached deleting
inventor(s) named in the prior application,
see 37 C.F.R. §§ 1.63(d)(2) and 1.33(b).

* NOTE FOR ITEMS 1 & 13: IN ORDER TO BE ENTITLED TO PAY SMALL ENTITY
FEES, A SMALL ENTITY STATEMENT IS REQUIRED (37 C.F.R. § 1.27), EXCEPT
IF ONE FILED IN A PRIOR APPLICATION IS RELIED UPON (37 C.F.R. § 1.28)

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5. ☐ Microfiche Computer Program (Appendix)
6. ☐ Nucleotide and/or Amino Acid Sequence Submission
(if applicable, all necessary)
 - a. ☐ Computer Readable Copy
 - b. ☐ Paper Copy (identical to computer copy)
 - c. ☐ Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

7. ☒ Assignment Papers (cover sheet & document(s))
8. ☐ 37 C.F.R. § 3.73(b) Statement of Power of Attorney
(when there is an assignee)
9. ☐ English Translation Document (if applicable)
10. ☐ Information Disclosure Statement (IDS)/PTO-1449 [Copies of IDS Citations]
11. ☐ Preliminary Amendment
12. ☒ Return Receipt Postcard (MPEP 503)
(Should be specifically itemized)
13. ☐ * Small Entity Statement filed in prior application.
Statement(s) Status still proper and desired
(PTO/SB/09-12)
14. ☐ Certified Copy of Priority Document(s)
(if foreign priority is claimed)
15. ☐ Other:

16. If a CONTINUING APPLICATION, check appropriate box, and supply the requisite information below and in a preliminary amendment:

☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No: _____
Prior application information: Examiner _____ Group / Art Unit: _____

For CONTINUATION or DIVISIONAL APPS only: The entire disclosure of the prior application, from which an oath or declaration is supplied under Box 4b, is considered a part of the disclosure of the accompanying continuation or divisional application and is hereby incorporated by reference. The incorporation can only be relied upon when a portion has been inadvertently omitted from the submitted application parts.

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Signature			Date 11-10-99

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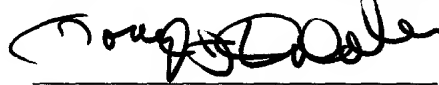
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Yoshiharu Chikazawa
Filed : Herewith
For : STEREOSCOPIC DISPLAY DEVICE WITH TWO
BACK LIGHT SOURCES

CERTIFICATE OF MAILING BY
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Date of Deposit: November 10, 1999

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Joseph J. Kolodka, Attorney
Registration No. 39,731

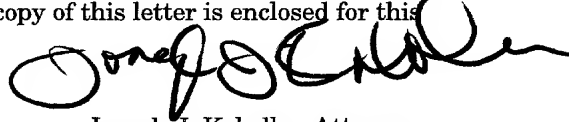
LETTER OF TRANSMITTAL AND APPLICATION FOR
GRANT OF LETTERS PATENT PURSUANT TO 37 CFR 1.53

Assistant Commissioner of Patents
Washington, D.C. 20231

Sir:

Application is hereby made this 10th day of November, 1999, in the name of and on behalf of Yoshiharu Chikazawa for grant of Letters Patent for the invention entitled STEREOSCOPIC DISPLAY DEVICE WITH TWO BACK LIGHT SOURCES which is claimed in the application attached hereto and identified with attorney docket number RCA 89,936.

Please charge the filing fee and any additional fee required or credit any overpayment to Deposit Account 07-0832. A copy of this letter is enclosed for this purpose.



Joseph J. Kolodka, Attorney
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JJK/kms

STEREOSCOPIC DISPLAY DEVICE WITH TWO BACK LIGHT SOURCES

BACKGROUND OF THE INVENTION

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The invention relates to a stereoscopic display device comprising a transmissive image reproducing element with two light sources on the rear side of this element.

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DESCRIPTION OF PRIOR ART

For reproducing stereoscopic TV images, it is known to provide, on a display, alternately, an image for the left eye and an image for the right eye and to provide optical means directing the left image to the left eye and the right image to the right eye.

It has been more particularly proposed a LCD type display device wherein the picture elements (pixels) of the transmissive LCD are alternately activated in order to reproduce the image for the left eye and the image for the right eye. In this known device, two light sources and a lens are provided on the rear side of the (LCD) image reproducing element. These sources are located in the focal plane of the lens. The position of one source is such that the parallel beam that it produces on the front side of the LCD is directed towards the right eye and the other source is located in a position for which the parallel beam that it produces is directed towards the left eye. These sources are activated in synchronism with the corresponding images. In other words, the source which provides light directed towards the right eye is lit when the right image is activated on the LCD.

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SUMMARY OF THE INVENTION

The invention is based on the recognition that the volume of the known device is hardly compatible with portable applications such as for lap top computers or individual movie displays.

In order to overcome this drawback, the invention provides mirror means to direct the light emitted by one light source towards the right eye and to direct the light emitted by the other source towards the left eye, the light sources and the image reproducing element being installed on the same side of the mirror means.

As, in the known device, the light sources and the image reproducing element are on opposite sides of a lens, the volume of the device according to the invention may be smaller than the volume of the known device.

The mirror means may provide parallel beams or converging beams.

BRIEF DESCRIPTION OF THE DRAWINGS

Other features and advantages of the invention will appear with the following description of some of its embodiments, this description being made in connection with the drawings in which:

figure 1 represents schematically a stereoscopic display according to an embodiment of the invention,

figure 2 represents a Fresnel mirror for the device of figure 1,

figure 3 is another representation of the device of figure 1,

figure 4 shows another type of Fresnel mirror for the device of figure 1 or figure 3, and

figure 5 shows an embodiment of the invention.

DESCRIPTION OF PREFERRED EMBODIMENTS

In the embodiments represented on the drawings, the stereoscopic display device comprises a liquid crystal display
5 10 comprising a multiplicity of pixels for which the transmissivity and the color is controlled in order to form the image. In order to display stereoscopic moving images, the period of one image (one frame) is divided into two fields wherein the first (or second) field produces the image for the
10 right eye and the second (or first) field produces the image for the left eye.

Two light sources 40 and 46 (figure 1 and figure 3) are lit alternately in synchronism with the reproduction of the images for the right eye and the images for the left eye. The
15 light source 40 is energized when the image for the right eye 44 is reproduced on LCD 10 and the light source 46 is energized when the LCD 10 reproduces the image for the left eye 48. In the embodiment shown, the mirror 42 (figure 1) or 42₁ (figure 4) is converging and of the Fresnel type. This mirror makes an image
20 of the right source 40 on the right eye 44 and an image of the left source 46 on the left eye 48.

During the first field, only the light source 40 is active and LCD 10 displays only the image for the right eye.

During the second field, only light source 46 is
25 active and LCD 10 displays only the left image.

As shown on figure 1, the light source 40 is active when the LCD 10 displays the right image and the converging mirror 42 makes the image of this source 40 on the right eye 44. Similarly, the light source 46 is active only when LCD 10
30 displays the left image and the mirror 42 makes the image of this source 46 on the left eye 48.

The position of LCD 10 with respect to sources 40, 46 and with respect to the mirror 42 must be such that the light from sources 40 and 46 must cross this LCD 10 only after having
35 been reflected by mirror 42.

The advantage of this embodiment is that it may be compact, because the light sources 40 and 46 are on the same side of mirror 42 as LCD 10. On the contrary, in the known device, the light sources, on one hand, and the LCD 10, on the other hand, are on opposite sides of a lens.

In the embodiments represented on the figures, the light sources 40 and 46 (figure 3) are elongated along one side of element 10 of rectangular shape.

The Fresnel mirror 42 represented on figure 2 has alternate elongated stripes 50_1 , 52_1 , 50_2 , 52_2 , etc. The direction of elongation is the direction of elongated light sources 40 and 46. The elongated stripes 50_1 , 50_2 , 50_3 ... 50_i ... form a first converging mirror and the second elongated stripes 52_1 , 52_2 ... 52_i ... form a second converging mirror. The first converging mirror is the one which makes the image of source 40 on the right eye 44 (figure 1) and the second mirror, with elongated elements 52_i , makes the image of light source 46 on the left eye 48.

In this example, the two Fresnel mirrors (stripes 50_i and 52_i) are of the cylindrical type.

In order to distribute the light energy of each source 40 and 46 on LCD 10, it is possible to use a diffuser and/or an optical integrator (not shown).

In the embodiment shown on figure 4, the Fresnel mirror 42_1 has also two types of alternated elongated stripes 54_1 , 56_1 , 54_2 , 56_2 , etc. which form converging mirrors for the right and the left eyes. But the shapes of these mirrors are such that they can be used in conjunction with light sources of the punctual type. For instance, the two mirrors define an ellipsoïdo-paraboloid of revolution.

The light sources may be of any type, for instance light emitting diodes (LED). One or several diodes may be used to form a punctual light source and these light diodes may be also disposed along a line in order to form elongated light sources.

The transmissive image reproducing element 10 may be of any type, either black and white or colored.

In another embodiment, the light sources 40 and 46 are at focal point(s) or plane(s) of a mirror and provide parallel beams respectively to right eye 44 and to left eye 48.

In the embodiment represented on figure 5, only one light source 60 is provided and the mirror means 62 comprises an array of mirror elements 64₁, 64₂, etc. the orientation of which is controlled by motor means and a control circuit, both being represented by a block 66. The goal of the block 66 is to focus the light beam generated by a source 60 and reflected by each mirror element, alternately on the right eye 68 and on the left eye 70.

Like in the embodiment represented on figure 1, the LCD 10 is controlled in order to display alternately the images for the right eye and for the left eye. This control of the display 10 is realized with a synchronization signal provided at an input 72₁ of a control circuit 72 for the LCD 10. Said control circuit 72 has also an input 72₂ receiving the signals for the left and the right images.

The same synchronization signal which is provided to the input 72₁ of control circuit 72 for the LCD 10 is also provided to an input 66₁ of the block 66 for controlling the tilt of mirror elements 64₁, 64₂, etc.

Compared to the embodiment of figure 1, only one light source 60 is provided instead of two. Therefore, the device is less bulky; this feature is particularly advantageous for a portable device.

The mirror elements 64₁, 64₂, etc. may be either elongated elements (stripes), preferably in one direction, as those represented with figure 2 and figure 4, or small elements disposed in a matrix -like manner. In the latter case, a plurality of elements are provided on each column and on each line.

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The control of the orientation or tilt of the mirrors may be realized conventionally like in a digital mirror device (DMD).

The light source 60 may have the shape of a point or
5 an elongated shape, like lamp 40 represented on figure 3.

It may be necessary to use optical means (not shown) for a correct focusing at points 68 and 70, these optical means being installed between the light source 60 and the mirror means 62 and/or between the mirror means 62 and the focus points 68
10 and 70.

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1. A stereoscopic display device comprising a transmissive image reproducing element, light source means, optical means to direct the light emitted by one light source towards the right eye and to direct the light emitted by the other light source towards the left eye, and control means for displaying alternately an image for the right eye and an image for the left eye on the image reproducing element, and for activating the source emitting light for the right eye only when the image for the right eye is displayed and for activating the source emitting light for the left eye only when the displayed image is for the left eye, wherein the optical means comprise mirror means and the light sources and the image reproducing element are installed on the same side of the mirror means.

3. A stereoscopic display device according to claim 1,
wherein the mirror means provide parallel beams towards the
20 eyes.

5. A stereoscopic display device according to claim 2,
25 wherein the mirror means are of the Fresnel type.

7. A stereoscopic display device according to claim 6, characterized in that the first and second mirror elements form an alternate succession.

8. A stereoscopic display device according to claim 6, characterized in that the mirror elements form stripes elongated in one direction.

5 9. A stereoscopic display device according to claim 1, characterized in that the mirror means form cylindrical mirror means or ellipsoïdo-paraboloid mirror means.

10 10. A stereoscopic display device according to claim 1, characterized in that the light sources are elongated in the same direction.

15 11. A stereoscopic display device according to claim 1, characterized in that the image reproducing element has a rectangular shape and in that the light sources are elongated along one side of this image reproducing element.

20 12. A stereoscopic display device according to claim 1, characterized in that the image reproducing element comprises a liquid crystal display element.

25 13. A stereoscopic display device according to claim 1, characterized in that the image for the right eye is formed during a field of a frame and the image for the left eye is formed during the other field of the frame.

30 14. A stereoscopic display device comprising a transmissive image reproducing element, light source means, optical means to direct the light emitted by light source means towards the right eye and towards the left eye, and control means for displaying alternately an image for the right eye and an image for the left eye on the image reproducing element, characterized in that the light source means comprises one single light source and in that the optical means comprise
35 mirror means comprising movable mirror elements associated with

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mirror control means able to control the orientation of the mirror elements in such a way that each element has a first and a second positions, the first position directing the light towards the right eye when the image for the right eye is displayed on the transmissive image reproducing element, and the second position directing the light from the light source towards the left eye when the displayed image is for the left eye.

15. A stereoscopic display according to claim 14,
10 characterized in that the mirror elements form stripes elongated
in one direction.

16. A stereoscopic display according to claim 14, characterized in that the mirror elements are of the punctual type, these mirror elements forming a matrix arrangement, a plurality of such elements being provided on each line of the matrix and a plurality of mirror elements being provided on each column of the matrix.

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STEREOSCOPIC DISPLAY DEVICE WITH TWO BACK LIGHT SOURCES

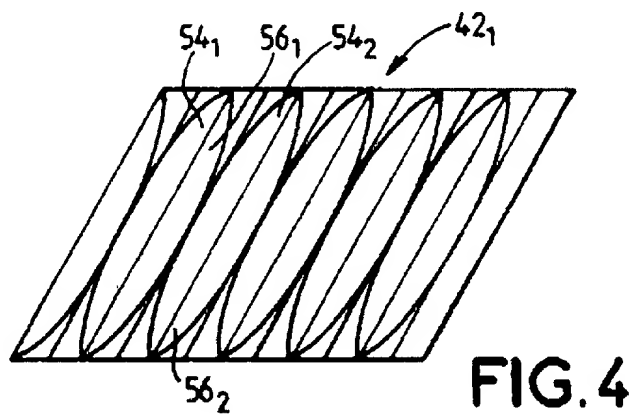
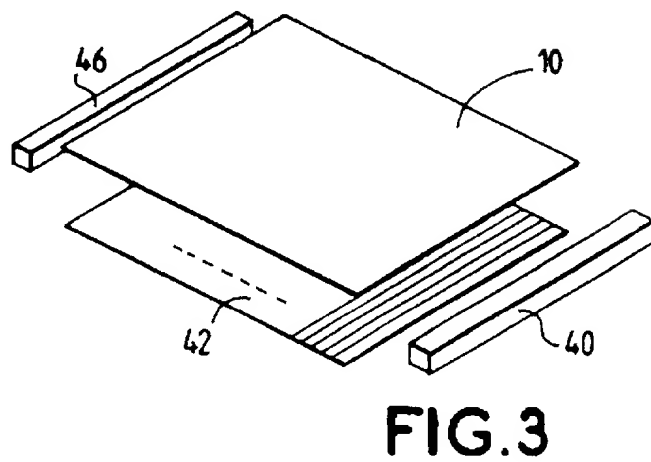
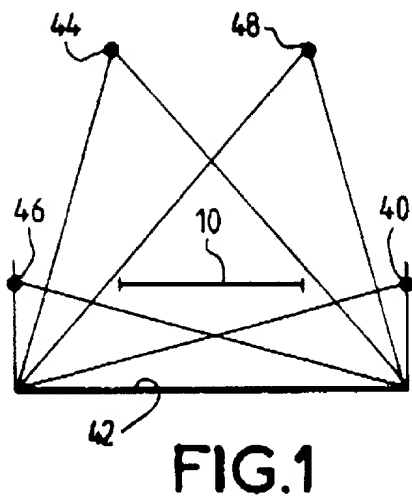
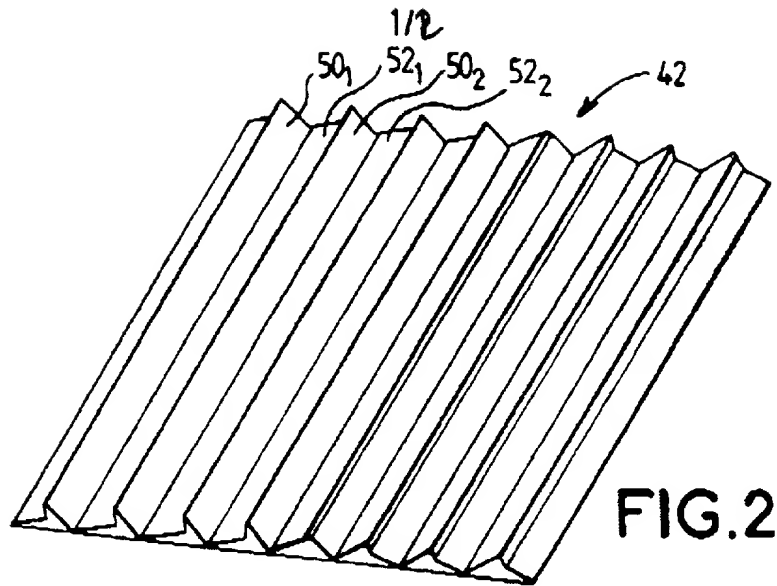
Abstract

The invention relates to a stereoscopic display device comprising a transmissive image reproducing element, two light sources, optical means to direct the light emitted by one light source towards the right eye and to direct the light emitted by the other light source towards the left eye, and control means for displaying alternately an image for the right eye and an image for the left eye on the image reproducing element, and for activating the source emitting light for the right eye only when the image for the right eye is displayed and for activating the source emitting light for the left eye only when the displayed image is for the left eye.

According to the invention the optical means comprise mirror means providing either a converging beam or a parallel beam.

The volume of this arrangement may be minimized.

Figure 1.



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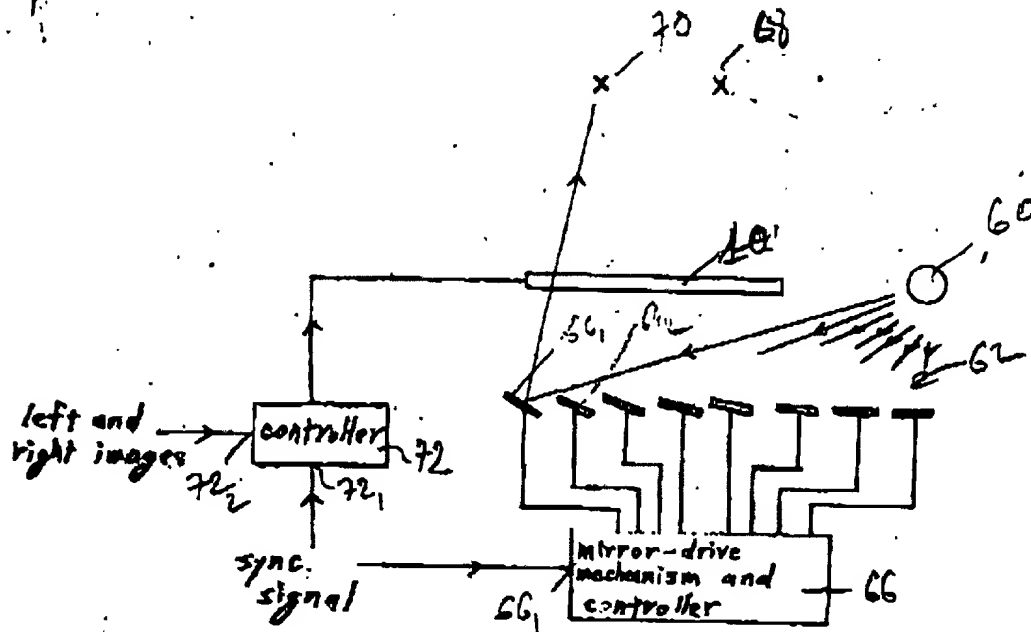


Fig. 5

[illegible]

- 1 -

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**DECLARATION FOR UNITED STATES PATENT APPLICATION,
POWER OF ATTORNEY, DESIGNATION OF CORRESPONDENCE ADDRESS**

As a below named inventor, I hereby declare that my residence, post office address and citizenship are as stated below next to my name, and that I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

STEREOSCOPIC DISPLAY DEVICE WITH TWO BACK LIGHT SOURCES

the specification of which

(CHECK ONE) (xx) is attached hereto.

()

was filed on

, Application Serial. No.

and was

amended on

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with 37 CFR 1.56(a).

I hereby claim foreign priority benefits under 35 USC 119 of any foreign application(s) for patent, utility model, design or inventor's certificate having a filing date before that of the application(s) on which priority is claimed:

Prior Foreign Application(s)			Priority Claimed	
Number	Country	Date Filed	Yes	No
98402818.3	EP	November 13, 1998	xx	
98402819.1	EP	November 13, 1998	xx	

I hereby claim the benefit under 35 USC 120 of any US Application(s) listed below, and, insofar as the subject matter of each of the claims of this Application is not disclosed in the prior US application in the manner provided by the first paragraph of 35 USC 112, I acknowledge the duty to disclose information which is material to the examination of this application in accordance with 37 CFR 1.56(a).

Serial No.:

Filed:

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that wilful false statements and the like so made are punishable by fine or imprisonment, or both, under of 18 USC 1001 and that such wilful false statements may jeopardize the validity of the application or any patent issued thereon.

I hereby appoint the following attorneys to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith: Joseph S. Tripoli (Reg. No. 28,040), Peter M. Emanuel (Reg. No. 26,542), Joseph J. Laks (Reg. No. 27,914), Eric Herrmann (Reg. No. 29,189) Telephone: (800) 734-9754

Address all correspondence to Joseph S. Tripoli, Patent Operations - THOMSON multimedia Licensing, Inc. - CN 5312 - Princeton, New Jersey 08543-0028.

Signature:

Date:

10 Nov.

1999.

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants : Yoshiharu Chikazawa
Filed : Herewith
For : STEREOSCOPIC DISPLAY DEVICE WITH TWO
BACK LIGHT SOURCES

APPOINTMENT OF ASSOCIATE ATTORNEY

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

I, Joseph J. Laks, an attorney of record, hereby appoint Joseph J. Kolodka, Registration No. 39,731, as associate attorney in the above-identified application, with full power to prosecute the above-identified application, to make alterations and amendments therein, and to transact all business in the Patent and Trademark Office connected therewith.

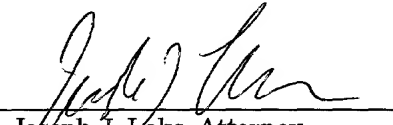
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Princeton, NJ 08543-0028

Respectfully submitted,

YOSHIHARU CHIKAZAWA

By



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